the left, and crossed the second and third dorsal vertebræ to the right side; the small intestines then commencing, took their direction from right to left, and entered the caput coli in the left ilium, the ascending colon passed up the left side of the belly, the descending down the right side, to form the sygmoid flexure in the right iliac fossa.

"The disposition of the blood vessels was also reserved. The inferior vena cava was placed, at least, half an inch to the left of the aorta; the left renal artery was the longer of the two, and passed behind the vena cava; whilst the right emulgent vein crossed before the aorta, and the right common iliac vein passed behind the left common iliac artery.

"Although a complete transposition of the contents of the abdomen existed, with exception of the wide separation of the great blood-vessels, the several viscera maintained their position with relation to each other, as when distributed in a natural manner."

The contents of the chest observed their natural disposition.

—

3. *Case of Complete Absence of the Uterus.*—A female, forty-six years of age, who had never enjoyed good health, and was of weakly constitution, had arrived at the age just mentioned without having once menstruated. At the period of puberty, the body and mammæ were well formed; but the menstrual discharge was replaced by a constant pricking pain in the left hypochondriac region, occasionally shooting down to the pelvis. The exacerbations of the pain were accompanied with vomiting, and occurred generally every month, but not regularly. In the twenty-sixth year of her age, for the first time, a slight discharge of blood took place from the vagina, the patient being affected with acute fever. At the age of forty-six she was compelled to have recourse to medical advice, from an increase of pain in the left hypochondrium. The symptoms were dissipated by antiphlogistic measures. The woman now permitted an examination of the genital organs; the external parts were in a normal state, but the vagina, which was about one inch in length, terminated in a cul de sac. In the course of a year this patient died of peritonitis; and, on examining the body, Dr. Albers found the internal genital organs in the following state: the vagina, as already said, terminated in a cul de sac. About one inch and a half from it, and placed laterally, were found two bodies not larger than a good-sized walnut; these were oblong in shape, and did not seem to have any connexion with the vagina; however, each of them sent off, upwards and sidewards, a distinct bundle of fibres, terminating in the vicinity of another body, which appeared to be the imperfectly developed ovary. Each of the oblong bodies, which we must consider as the rudimentary elements of the uterus, contained a small cavity, lined with a membrane analogous to mucous membrane. The tissue of the parietes, not more than two lines thick, was soft and fibrous. It was not easy to distinguish it from the round and broad ligaments, as all the parts together were enveloped in a mass of cellular tissue.

The Medical Society of Toulouse was lately occupied with the case of a woman in whom also probably the uterus was wanting. The vagina here terminated in a cul de sac; the patient had never menstruated, and external examination could discover no trace of a uterus. Dr. Hohlfeld, of Berlin, has treated a similar case. The female, twenty-five years of age, had never menstruated. This was attributed to obstruction of the vagina. An operation was performed with the object of establishing a communication between the vagina and supposed uterus, but without success.—*Lancet*, 9*th Jan.* 1836, from *Kleinert's Repertorium*, 24*th Sept.* 1835.

PHYSIOLOGY.

4. *Professor Panizza's Experiments upon the Nerves of the Tongue, with the view of Determining their Respective Functions.*—The *London Medical Gazette* for 19th Sept. last, contains a notice of these interesting experiments, by Dr. Burrows. The memoir of the Professor of Pavia (*Richerche sperimentali sopra i*

Nervi) not having reached us, we take the following account of these experiments from the communication of Dr. Burrows.

The controversy which has long existed respecting the nerve which supplies the sense of taste, and various considerations which led Prof. P. to distrust all that had been advanced on the subject, determined him to discover by means of infallible facts, the function performed by each of the cerebral nerves, distributed to the tongue.

Prof. P. commenced with experiments upon the hypoglossal, and then proceeded to the lingual, and lastly to the glosso-pharyngeal. He chose the dog generally for these experiments, because this animal combines a great mobility of the tongue with an exquisite sense of taste, but he has not omitted extending his observations to other animals.

"Having muzzled and secured the legs of a dog, it was laid on the back, and an incision of the integuments made in the mesian line, in front of the os hyoides. In order to discover the hypoglossal nerve, the integuments must be detached for some distance on either side; the paniculus carnosus is then divided, and carefully removing the cellular tissue beneath, the lingual artery and hypoglossal nerve are brought into view. In this proceeding, it is desirable to keep close upon the os hyoides, by which means the nerve is reached before it passes under the mylohyoideus muscle. The nerve must be then separated from its connexion with the lingual artery, and a small portion of the nerve cut out and removed. Before the piece was cut out, and while the nerve was elevated by a probe, it was pricked with the point of the scissors, and the tongue was immediately convulsed; but the animal showed no signs of pain, neither was any pain evinced in the operation of excision.

The effect which follows the division of the hypoglossal pair of nerves is the immediate and permanent loss of all the motions of the tongue, the senses of taste and touch remaining. In fact, if a certain quantity of milk is offered to a dog after this operation, he greedily puts his nose to it, and makes those movements with his head and lower jaw which he would do to lap it up, but he does not put out his tongue to the very smallest extent; so that after many useless efforts, he abandons the attempt. There was no doubt that the milk was not touched, for the surface was never rippled, and after the experiment it was weighed, and found the same quantity as before. If a piece of bread, soaked in milk, is offered to the dog, he takes it into his mouth with eagerness, attempts to masticate it, but shortly lets it fall upon the floor, scarcely divided in halves; one of these he will take up again, subdivide it, and let them fall again; and so on until he turns away from the broken bits. In the various movements made to masticate it, if it should happen that in bending the head downwards the tip of the tongue should protrude at the angle of the mouth, it remains there flaccid, and the animal bites it, and suffers pain. One of the dogs thus submitted to experiment was so gentle, that it licked the hand upon being caressed; and after the division of the hypoglossal pair, it made the same attempts to lick the hand, but it was unable to put its tongue out of its mouth. Not only the voluntary movements of the tongue, and those which assist in mastication, are destroyed by the excision of a portion of each hypoglossal nerve, but also those motions of the tongue which contribute to the act of deglutition are also annihilated. A bolus of small pieces of bread and meat was made, and placed upon the dorsum of the dog's tongue. At first he made various movements, which showed the difficulty he experienced in moving the ball of food from the spot on which it was placed, but at the same time led to the belief that he would accomplish the mastication, and swallowing of it; but if the bolus did not happen to be displaced by its own weight, or by the motions of the lower jaw, and thus to be thrown out of the mouth, or between the tongue and the teeth, it was still found on the tongue, even after the lapse of many hours. Deglutition is not accomplished except when the ball of food reaches the cavity of the pharynx, and then by the simple action of the pharyngeal muscles; but even in this case deglutition is imperfectly performed, inasmuch as the ball of food, being compressed by these muscles, is broken to pieces, and returns in part into the mouth through the isthmus faucium, which is not closed by the paralyzed tongue. The same thing happens if water is poured into the fauces of the dog, for the purpose of giving him drink. On these accounts it costs great time and trouble to keep the dog alive.

The attempts made by the dog to displace the food from the back of the tongue, the pain he suffered upon accidentally biting it, and the endeavours he made to replace the tongue in its natural position when it was put on one side in feeding him, are all facts which prove that the dog feels his own tongue, and with it feels the contact of foreign bodies. To make more certain of this point, the tip of the tongue was pricked, and the animal gave signs of acute pain; and after a little time, a small hook was put into the middle of the tongue, with the intention of drawing the tongue forward, but the dog howled so loud, and resisted so much, that the hook was removed, from fear of tearing the tongue. When the tongue was pricked towards the base, it gave evident pain, and occasioned efforts to vomit. It is therefore quite clear that the sense of touch remains after the excision of portions of the hypoglossal nerves.

In the foregoing experiment, it was not clear whether the sense of taste was affected; for although the dog attempted to masticate a piece of meat, he might have been induced so to do by the sense of touch, or smell, or taste. To illustrate this point, a small feather, previously dipped into a solution of colocynth (which has a sour disagreeable taste, and no smell) was lightly applied to the dorsum of the dog's tongue; the animal quickly showed, by the movements of his head, by turning up his lips, and other signs indicative of disgust, how disagreeable the flavour was. A piece of bread soaked in the same solution, and put into the animal's mouth, occasioned the same marks of dislike to the taste of the colocynth. From this we may infer that the peculiar sense of the tongue is preserved after the excision of the hypoglossal nerves.

Similar experiments were performed upon sheep, with precisely identical results: the animal was no longer able to draw into the mouth, by means of the tongue, twigs, and leaves, and herbage; besides this, the bleating became harsh, and not so loud as before.

Thus then since it appears that the excision of the hypoglossal nerves immediately and entirely destroys the motions of the tongue, there can be no doubt but that this nerve is the efficient cause of those movements; and, on the other hand, as the sense of touch of the tongue and taste remains unimpaired, there can be no doubt that these functions depend upon some other sources of nervous influence.

To expose the lingual branch of the fifth pair of cerebral nerves, it is desirable to make an incision through the integuments in the mesian line, from the os hyoides nearly to the symphysis of the jaw. The integuments must then be reflected from the subjacent cutaneous muscle on either side, as far as the edge of the depressor muscle of the jaw. Then, upon dividing the cutaneous muscle, the mylohyoides is exposed; and this latter muscle must be cut through, to the extent of half or a whole inch, according to the size of the dog; when, upon turning on one side the edges of the divided muscle, the branches of the lingual nerve are brought into view. Care must now be taken to follow the course of the nerve backwards to the point where it gives off a branch which is distributed to the frænum of the tongue. After the nerve is separated from its surrounding attachments it is divided, and a portion removed to prevent reunion. The wound is then to be closed, and the edges kept together by stitches.

The effect which immediately follows this excision of a portion of each lingual nerve, is the complete annihilation of all sense of feeling in the tongue, while motion and taste both remain. In fact, it not unfrequently happens that the dog upon being set at liberty, begins to lick his nose and paws, especially if they are stained with blood.

If some milk, or bread, or meat, is offered to the dog, he eats and drinks readily, although, after the operation, it sometimes appears that the dog laps up the milk and masticates his food rather slowly, which may arise from the loss of the sense of touch, or in consequence of the deep wound. If, on the other hand, just enough colocynth, or infusion of quassia, be added to the milk, so as to give a bitter taste without altering the colour, or a piece of bread be dipped into the milk, or, indeed, merely a few drops of the bitter liquid poured between the fibres of a piece of flesh, the animal, which up to this moment had evinced the strongest desire for meat and drink, immediately refuses both one and the other after taking one mouthful of either. If a piece of meat prepared with the bitter solution is mixed with several other, and the dog accidentally take it into his mouth, he immedi ately rejects it, and often refuses to eat any more.

These facts alone would not prove that the sense of taste still exists in the tongue, because the bitter flavour may be perceived by other parts of the mouth. In order to dissipate all doubt, it is therefore desirable that the bitter substance should merely touch the tongue itself; and to accomplish this, it is best to take a small feather, previously slightly dipped in the bitter fluid, and to draw it lightly along the dorsum of the tongue, taking great care the fluid does not extend beyond the points touched by the feather. With these precautions the animal still evinces the same marks of strong distaste for the flavour.

Thus, then, the division of the lingual pair of nerves neither destroys the motions of the tongue, nor that peculiar sense which resides principally in that organ.

The sense of feeling is that which suffers by the above-mentioned operation; and this is clearly shewn by the indifference and absence of all suffering on the part of the animal when severe injuries are inflicted upon the tongue. Thus punctures, the cautery, deep incisions and wounds made by the animal's teeth, cause no pain. Although some slight hesitation is occasionally observed in the acts of lapping up and masticating, still the animal uses his tongue freely. Indeed it would seem that the loss of feeling ought to occasion some obstacle to the perfect accomplishment of these acts, inasmuch as a part which is no longer felt, and which itself no longer feels, cannot be freely influenced by the will. But in this case is it not probable that the peculiar sense of taste, by means of flavours, may in part supply the loss of the sense of feeling? In this case, then, it will not surprise that the loss of feeling in the tongue does not induce all the effects which it would produce in other parts.

Since, then, by the division of the two lingual branches of the fifth pair, the sense of feeling in the tongue is destroyed, these nerves preside over this sense, which corresponds with the functions of the fifth pair in all the other parts of the face. On the other hand, if the motions of the tongue and taste are preserved, these functions of the tongue do not depend on these same nerves; or, at least, they do not depend on them primarily and solely. Moreover, if the motions of the tongue and the taste were destroyed, together with the sense of feeling, by the division of the nerves of the fifth pair, it would not be a proof that these presided over those two functions, but simply that the integrity of the sense of feeling was essential to the manifestation of the other two functions. It has been already shown from what nerve really proceeds every motion of the tongue, and it will shortly be stated from whence arises the sense of taste.

There are some, however, who maintain that the sense of taste results from the combined influence of the hypo-glossal and lingual branches of the fifth pair. To disprove this opinion both these nerves were simultaneously divided in the same animal, and the tongue was immediately deprived of all motion, and of the sense of feeling, whilst the taste remained unimpaired; so that upon touching any part of the tongue, and particularly towards the base, with the solution of colocynth, the dog evinces the strongest marks of disgust. The sense of taste, then, does not depend upon the combined influence of these two nerves, but upon the remaining undivided nerve; whilst the other functions of the tongue, which do not depend upon it, were successively annihilated by the successive division of the other nerves.

Although the conclusions from the foregoing experiments would be satisfactory to some persons, still (continues Panizza) it is better to proceed to direct experiments on the glosso-pharyngeal nerves. The division of these nerves is rather a delicate than a difficult operation. Having made an incision through the integuments along the mesian line, from the thyroid cartilage to the chin, the integuments are to be separated from the panniculus carnosus, as far as the angle of the jaw, and this muscle cut through along the course of the internal margin of the depressor muscle of the jaw. The edges of these parts, and any lymphatic glands there, must be turned on one side; and thus the space which exists between the depressor muscle of the jaw and the os hyoides is exposed; and it is in the very bottom of this space, filled up by cellular tissue and many large veins, that the glosso-pharyngeal nerve must be sought just coming out from the cranium.

The cellular tissue must be removed with the greatest care, to avoid wounding the large veins; and it greatly facilitates the operation to have the edges of the wound drawn apart, and the bottom well cleansed of blood. A few fibres of the constrictor muscle of the pharynx are to be separated, and the glosso-pharyngeal nerve is then exposed. The nerve being insulated, it is desirable to divide it near its exit from the cranium, so as to comprise all its filaments. If the nerve be pricked before it is divided, the animal neither shows any signs of pain, nor is the tongue convulsed; the same is observed in actually dividing the nerve.

The effect which ensues is the complete loss of taste, whilst the motions and the sense of feeling of the tongue remain.

As soon as the dog had a little recovered himself after the operation of the division of the glosso-pharyngeal nerves, he licked up some water, and ate as freely as if no injury had been done to him. The animal had no other guide than the sense of smell in the choice of food, so that he will equally take into his mouth disagreeable and hurtful substances as well as pleasant and wholesome. The dog after this experiment ate with equal voracity plain meat as well as that imbued with colocynth, and equally drank the plain milk and that rendered bitter by colocynth. The dog not only devoured a piece of meat which had been beaten up with some colocynth, but even lapped up the remainder of the liquid in the plate.

Similar experiments were made at the same time with a dog whose lingual nerves of the fifth pair had been divided After this latter animal had caught in his mouth several pieces of plain meat which were thrown to him, he readily took in the same manner a piece with the bitter flavour; but he had scarcely got it into his throat before he was seized with vomiting, and he rejected this piece. A most remarkable contrast between the dogs was now observed; for the animal whose glosso-pharyngeal nerves were divided, immediately ate this rejected piece of meat. Nevertheless, this latter animal still preserved the sense of feeling in the tongue; for immediately on its being pricked the dog howled, and attempted to run away.

If, then, the division of the glosso-pharyngeal nerves causes a loss of the sense of taste, there can be no doubt but that this sense depends on that nerve, to which therefore, properly belongs the title of *gustatory nerve;* and if the division of these nerves causes no impairment of the motions of the tongue, nor of the sense of feeling, it is likewise certain that these functions do not at all depend upon these glosso-pharyngeal nerves.

In fact when the glosso-pharyngeal nerve is diligently examined, either in man or animals, as in the dog upon which these experiments were principally performed, it appears that, without giving off a single filament to the muscles through which it passes, the nerve is entirely distributed to the mucous membrane of the tongue and to the surrounding parts, which, in common with the tongue, enjoy the sense of taste; this sense is most exquisite there, where the filaments of the nerve are most abundant—that is, towards the base of the tongue.

In this manner, then, having established that the gustatory functions belong to the glosso-pharyngeal nerves, it appears that many phenomena of intimate sympathy which exist between the tongue and the stomach, are in this way much more easily and directly explained than was done by assigning the sense of taste to the lingual branch of the fifth pair.

"From these experiments upon the tongue, it is at last shewn, if I do not deceive myself," says Panizza, "that each of its nerves belonging to the cerebro-spinal axis presides exclusively over one function, and that each in turn assists the other to accomplish a wonderful variety of effects. So entirely is it true, that nature, who is so complicated and varied in her operations, is most simple in the means she employs."

—

5. *On the Mechanism of the Bruit de Soufflet.*—Dr. Corrigan communicated to the Medical section of the British Association, at the meeting in Dublin, a memoir on this subject. The first part of the paper consisted of an analysis of the various theories which had been proposed to account for this sound and its varieties, *bruit de rape*, &c. Laennec supposed it to be produced by spasmodic action, but his opinion has been generally abandoned. By some the sound has been attributed to increased pressure made by narrowing of the heart or arteries,—but it is

heard in permanent patency of the aorta, in the vessels of the pregnant uterus, in aneurismal dilatation of arteries in varicose tumours, in all which instances there is no narrowing;—by others to increased velocity in the motion of the blood; but it is not heard in the circulation of the fœtus or infant, while it is audible in the slower circulation of the mother; nor in the quickened pulse of hectic or inflammatory fever, while it is audible with a pulse of 70. By others it is attributed to roughnesses in the interior of arteries, or irregularities, over which the blood, in passing, produces the sound; but it is not heard in the healthy heart, the internal surface of which is exceedingly irregular; nor is it necessarily present in aneurisms, rough and irregular on their inner surface, from shape, or from deposition of fibrine; the sound, on the contrary, being frequently heard when there is no deviation from the natural state of the interior surfaces of the heart or arteries.

The second part of the paper developed Dr. Corrigan's views. His theory is, that the sound depends on the simultaneous presence of these two conditions, viz: 1st, a current-like motion of the blood (instead of its natural equable movement,) tending to produce corresponding vibrations on the sides of the cavities or arteries through which it is moving; and, 2ndly, a state of the arteries or cavities themselves by which, instead of being kept in a state of tense approximation on their contained inelastic blood (which would necessarily prevent any vibration of their sides,) they become free to vibrate to the play of the currents within on their parietes; and by those vibrations cause, on the sense of touch, "*fremissement*," and on the sense of hearing, "*bruit de soufflet*." It was shown that these two conditions are present in the parietes of the ventricle, and the currents of blood striking against them in cases of narrowed auriculo-ventricular openings; in the enlarged and tortuous arteries of the placental portion of the uterus permitted by their very free anastomosis with veins and sinuses, and other causes, to become partially flaccid in the intervals of the heart's contractions, and the irregular currents necessarily assumed by the blood in rushing along these comparatively flaccid tubes at their next diastole; and that similar conditions exist in the analagous state of the vessels in aneurismal dilatations of tortuous arteries. The presence of the two conditions was also applied to explain the mechanism of the sound in permanent patency of the mouth of the aorta, in the large arteries of animals dying of hæmorrhage, and in various other instances. In conclusion, two experiments were detailed, in which, in one instance, a small bladder, and in the other a portion of the gut of an animal, was interposed between two cocks, the upper or nearer being the cock of a water-cistern, and the lower or further constituting the discharging orifice of the bladder or gut, and water then allowed to flow through from the cistern. The sound "*bruit de soufflet*," and the sensation "*fremissement*," were perceptible in the intervening bladder or gut, until (from the upper pipe pouring in fluid faster than the lower discharged it) the bladder or gut became tense, and then both sensations ceased, the passage of the fluid through, nevertheless, continuing all the time. The experiment with the bladder was applied to explain the occasional presence and absence of "*bruit de soufflet*" in aneurisms, the sound being present in an aneurism when, from any circumstance connected with it, its parietes can become at all flaccid in the intervals of the heart's contractions,—not being heard if the parietes remain tensely applied to their contained fluid.

Dr. Corrigan has in some experiments substituted a gum-elastic tube for the portion of gut.—*Lond. & Ed. Philos. Mag.*, Dec. 1835.

---

6. *On the different offices of Lacteals, Lymphatics and Veins in the Function of Absorption.*—Dr. Handyside, of Edinburgh, presented to the Medical Section of the British Association, at the Dublin meeting, an interesting paper on this subject, in which, after starting with the proposition, now generally admitted, that these three set of vessels are one and all of them endowed with the faculty of absorption, he proceeds to lay down, as a general position, that each of these three systems of vessels is endowed with a peculiar office in the general function of absorption:

1st. That the lacteals absorb aliment, and refuse entrance to all other matters.

2nd. That the lymphatics remove the elements of the body which have become useless or noxious, to make room for the deposition of new matter.

3d. That the veins, besides returning the blood to the heart, absorb various foreign matters.

1st. *Function of Lacteals.*—This appears to be decidedly to convey nutriment into the system, and that no other class of vessels can exercise that function would appear almost proved to demonstration by the experiments of Dupuytren, in which it was ascertained, that by applying ligatures round the thoracic duct of horses, death from inanition followed in all instances.

2nd. *Function of Lymphatics.*—Closely as the lymphatic system resembles the lacteal, even in the most minute details of anatomical characters, the vessels composing it nevertheless appear to have for their peculiar function the office of removing the debris of the body. After noticing the arguments of Dr. Hunter and Mr. Hewson as to this function being performed by the lymphatics, Dr. H. ingeniously observed, that in vegetables the debris, instead of being removed by vessels, are detached from their surface, as in the falling off of their leaves and the scaling off of their bark, or they are piled up in the interior of the individual, (as heart wood,) and preserved during the whole period of its existence; which circumstance, taken in connexion with the absence of a system of vessels in vegetables corresponding to lymphatics, may be regarded as affording a negative proof in support of the opinion here stated.

Dr. H. next alludes to the supposed communication between the veins and lymphatics, which he maintains does not exist except where great lymphatic trunks empty themselves into the venous system; thus showing an independent existence of the lacteal system, which argues in favour of their having to perform a separate function.

3d. *Absorption by Veins.*—Several experiments were detailed, proving that the absorption of fluids from the surfaces of serous and mucous membranes, and from the surface of the skin, was accomplished by the veins and not by any other vessels. These experiments consisted in the exposure of fluids containing ferrocyanate of potass and prussiate of potass to the serous and mucous surfaces, and to the skin stripped of its cuticle. Absorption of the fluids so applied took place, and by the application of suitable tests, the sulphate and deuto-sulphate of iron, the presence of the salts above mentioned was discovered in the blood, but never in the fluid contained in the thoracic duct.

The results of these experiments were similar to those of Flandrin, Tiedemann and Gmelin, and Magendie, and prove that absorption from the surfaces of the various organs is affected by the veins.

The last point alluded to is the absorption of foreign matters from the interstices of the tissues of the body.

Having pointed out in the experiments of Magendie, Edwards, Vavasseur and Brodie, instituted with the view of proving interstitial absorption by veins, as an objection to the conclusions which these physiologists arrived at, that in every instance the substances acted upon were introduced into fresh wounds, by which they were brought into contact with the blood passing into the vessel in its course to the heart. Dr. H. suggested and performed two experiments, which he considers to be free from the objections which he urges against the experiments of the foregoing authors.

They were as follow:

Exp. 1. Having made a fistulous opening in the abdominal parietes of a dog, I took advantage of the period when a complete granulating surface should be formed, to apply to it very freely the solution of prussiate of potass. On killing the animal three minutes after the application, and applying the appropriate chemical test to the blood, it was shown to exhibit traces of the poison.

Exp. 2 was performed by applying prussiate of potass, in solution, to a granulating surface on the back of a cat, for four hours, and at the end of that period the presence of the poison was discovered by the test in the blood from the carotid arteries, but no indication whatever of its presence was observed in the lymph.

From all the reasoning advanced and experiments detailed in this paper, the author has considered it proved, that the absorption of foreign matters, occurring from the interstices and surfaces of the body, occurs solely through the channel of the venous system.—*Dublin Journ. Med. and Chem. Science, Sept.* 1835.

7. *On the Motions and Sounds of the Heart.*—The following interesting report

respecting the successive motions of the different parts of the heart, and the sounds that accompany them, was made to the Medical Section of the British Association, at their meeting in Dublin.

"The committee having met several times, and having considered the different opinions hitherto advanced on the subject of the motions and sounds of the heart, proceeded to institute a series of experiments, the subjects of which were generally young calves; in which animals the heart is sufficiently large to admit of the motions and sounds being accurately observed, while their early age is favourable to the prolongation of the experiment, as it has been ascertained that the vitality of the different organs is more enduring, and less influenced by injuries to the individual, in animals at a very early age, than in those of a maturer growth. The pulse varied in the subjects for experiment from 76 to 80.

"The animals were prepared in the following manner:—a tube connected with a pair of bellows was inserted into the trachea, and the sensibility of the animals having been destroyed by a blow on the forehead, artificial respiration was commenced, by means of which the heart was enabled to continue its pulsations for a period varying in different subjects from one hour to two. The committee had been disappointed in their endeavours to procure some of the woorara poison, which has been used in similar experiments in London; and found, that the employment of prussic acid, in a quantity sufficient to suspend the sensibility of the animal, destroyed, in a few minutes, the power of motion in the heart.

"SECTION I.—*Experiments on the Motions of the Heart.*

Exp. 1. A calf, two days old, having been secured on its back, and prepared as above described, the sternum and a portion of the ribs on both sides were removed, when the following motions were observed. The heart was beating strongly, at the rate of 144 pulsations in the minute, but in a short time fell to 80. While still enclosed in the pericardium, the heart was observed to have a slight vibratory motion on its longitudinal axis, which motion, it may here be remarked, may assist in explaining the phenomenon of *frottement* in disease. On cutting open the pericardium, and turning it aside, both the auricular appendices were seen to project with a rapid motion upwards, or towards the place of the sternum, and immediately afterwards to recede. When coming forwards, they were swollen and soft to the touch; when receding they became hard to the touch, were diminished in size, and flattened. Immediately after the recession of the auricular appendices, the ventricles with a rapid motion assumed a somewhat globular form in their middle part, which projected towards their sternum, and their apex at the same time was pushed considerably in the same direction. During their continuance in this state, the ventricles were hard to the touch, and if grasped by the hand, at the commencement of the movement, they communicated a shock or impulse, and separated the fingers. When the ventricles had remained for a short time in the state just described, they suddenly sank downwards or towards the spine, and became elongated, broad and flat, and soft to the touch.

"This succession of motions having been observed for some time, a small glass tube was introduced through a puncture into the left auricular appendix, and the blood was seen to rise in the tube during the recession of the appendix, and to subside during its upward movement. A similar tube was introduced through a puncture in the right ventricle, and a jet of dark coloured blood was thrown forth during the globular and hardened state of the ventricles, and subsided when they became flattened and soft. A puncture was made in the pulmonary artery, close to the ventricle from which it arises, and through it a stream of blood issued synchronously with the jet from the tube in the right ventricle. A tube having been introduced through a puncture in the left ventricle, and one of the mesenteric arteries having been exposed and opened, the jet from the ventricles was observed to precede the jet from the arteries, by an interval easily appreciable. The femoral artery was opened, and a similar observation was made as to the interval between the jet from the left ventricle and the jet from that artery. Previously to opening the chest, the committee had satisfied themselves, that the beat of the heart, felt through the sternum and cartilages of the ribs, preceded the pulse, felt in arteries at different distances from the heart, by intervals of time which were proportioned to those distances: and they were also satisfied, that the jets of blood from the mesenteric and femoral arteries were synchronous with the pulses felt in those arteries.

"*Exp.* 2. In a calf, prepared as the former had been, and placed on its right side, a portion of the ribs on the left side was removed, the sternum and part of the cartilages on that side being left in their natural position, and the pericardium was opened. It was now seen that when the ventricles assumed their hardened state, their apex, and a considerable portion of their anterior surface were closely applied to the sternum, and when the hand was interposed between the latter and the surface of the ventricles, a strong compression was exercised on the fingers during each approach of the ventricles to the front of the chest. When the ventricles were in their softened state, their anterior surface, by which is meant the one corresponding to that called anterior in the human heart, was sometimes in contact with the sternum, and sometimes removed to a little distance from it, and from the contemplation of this, and the preceding experiment, the committee were satisfied, that the situation of the heart in the thorax is affected by the position of the body, as has been observed by others; for instance, that in the recumbent state, on the back, the heart recedes somewhat from the sternum: if the individual lie upon the face, the anterior surface of the ventricles is in constant apposition with the front of the chest, the pericardium of course being interposed. The yielding texture of the lungs, and the mode of attachment of the pericardium and the great vessels, are such, as to allow the gravitation of the heart to influence its position in different postures of the body. These experiments were repeated on different subjects, and the observations recorded above were confirmed.

Exp. 3. A rabbit was stunned, and its heart immediately taken out of the body and placed on the hand, with the anterior surface of the ventricles upwards. The ventricles continued to beat for some time, and assumed alternately the forms which have been described in the first experiment. During the continuance of the globular form, the body of the ventricles was protruded upwards, and their apex was considerably elevated from the hand: and while in this state, it was ascertained by measurement, with a pair of compasses, that the length and the breadth of the ventricles were diminished. On the collapse, or softened state of the ventricles, taking place, they became longer and flatter, and their apex sank towards the hand. The heart was now placed with the posterior surface of the ventricles upwards, and the globular swelling, in their middle part, was observed to alternate with the flattened form on this surface also; but the apex was not elevated as in the preceding part of the experiment.

"*Exp.* 4. The sternum of a frog having been removed, the following appearances were observed. The ventricle having become swollen, soft and red-coloured, sank and diminished in size, and became pale and hard; alternating in these qualities with similar qualities in the auricle. It was manifest from the colour of both ventricle and auricle in their swollen state, that they were then full of blood; and from their softness, that they were in their diastole.—When they became pale and diminished in size, they were in their systole. During the diastole of the ventricle, its anterior surface was protuberant and approached the sternum, while its apex drooped towards the spine. In its systole, the anterior surface receded from the sternum, and its apex was slightly turned upwards or towards the sternum. The finger being applied to the ventricle during its systole, a slight shock or impulse was felt. In this experiment the relations between the sternum and the ventricle, during the diastole and systole of the latter, are nearly the reverse of those observed in the hearts of quadrupeds in the foregoing experiments. In these the ventricles approach the sternum, during the hardened state or systole, and recede from it in the softened state or diastole. This difference depends on the dissimilarity of the heart in warm and cold-blooded animals, and will be adverted to again.

"SECTION II.—*On the Sounds of the Heart.*

"*Exp.* 5. A stethoscope was applied on the sternum, over the heart, in a calf in which artificial respiration had been established, and both sounds of the heart were distinctly heard; the first prolonged and dull, the second abrupt and clear. The sternum and ribs were removed, so that the heart beat free from the contact of any part of the thorax, and a stethoscope, connected with a flexible tube and ear-piece, having been placed on the pericardium, over the ventricles, both sounds were distinctly heard. In the experiments on the sounds of the heart, with the sternum removed, the flexible ear-tube was found to be serviceable in preventing the transmission of the shock or impulse, which was felt when the common stethoscope was used, and which embarrassed the observation. The ear was now applied very near to, but not touching the heart, and both sounds were distinguishable, but feeble. A small piece of board was placed over the surface of the ventricles, and kept in contact with the pericardium, and the common stethoscope having been applied to the surface of the board, both sounds were heard as distinctly, and very nearly as strongly, as when heard through the sternum. The ear-tube was placed on the ventricles, near their apex, and in this condition, the first sound was very distinctly heard; the second sound indistinctly. When the tube was placed over the origins of the large arteries, both sounds were heard distinctly, particularly the second sound. The pericardium was distended with tepid water, and in that state, both sounds were heard, but not so clearly as before the injection of the water.

"*Exp.* 6. In a calf, prepared as before, the sternum and ribs having been removed as in the last experiment, and the pericardium having been cut away, both sounds were listened to with the ear-tube applied to the different parts of the ventricles, with the same result as in the last experiment. The great arteries were compressed close to the heart, and the character of the second sound was altered; and at times it seemed to some of the committee that the second sound was lost, the first sound remaining unchanged. A fine curved needle was passed into the aorta, and another into the pulmonary artery, beneath the line of attachment of one of the semilunar valves in each vessel, and the needles were passed about half an inch upwards, and out again through the respective vessels, so as to confine a valve in each, between the needle and the side of the artery: upon applying the ear-tube over the origins of the arteries, it was found that the second sound had ceased, and that a sound resembling the first in character, and coinciding with the systole of the ventricle, was still audible. Some of the members of the committee thought that the sound just mentioned was prolonged beyond the usual duration of the first sound, as heard before the introduction of the needles; and towards the termination of the experiment, it was observed by some of the committee, that there seemed to be a repetition of the first sound, or two prolonged sounds similar in character, and which might be called rushing sounds.

"When the heart was removed from the body, and the semilunar valves examined, it was found that one valve in each artery had been confined against the side of the vessel, so as completely to prevent its descent. It may be remarked, that this operation may be performed with great ease, and almost with certainty of success.

"*Exp.* 7. The foregoing experiment was repeated on another calf, and with the same result, the cessation of the second sound. During the experiment, the second sound, somewhat modified, was heard to recur; and upon examination it was found, that the needle, which had been passed into the aorta, had slipped out. On its being replaced, the second sound again ceased. On taking out this heart also, the valves were found to have been confined, as stated in the last experiment.

"*Exp.* 8. A calf having been stunned, the heart was taken out immediately, and placed on the table. The ear-tube was applied to the surface of the ventricles whilst they were still beating, and at each systole a sound was heard resembling that called the first sound; no second sound was audible. When the heart had ceased to beat, the semilunar valves were destroyed, the ventricles were filled with water, and the heart being held upright, the ear-tube applied to the ventricles, and these compressed by the hand, so as to cause a rush of water through the arterial trunks, a sound resembling the first sound was heard; also, when the grasp of the hand was suddenly relaxed, a sound was heard of the same character as the preceding. The ear-tube having been applied to the ventricles in the dead empty heart, and their internal surfaces being caused to rub against each other, a sound somewhat resembling the first sound was heard. The finger having been introduced into the left ventricle through the auriculo-ventricular opening, and gently rubbed against the internal surface, a sound was produced resembling the first sound, and heard by the ear-tube applied externally to the ventricles. A glass tube, allowed to drop from a small height on the semilunar valves of the aorta, before they had been destroyed, caused a sound having the character of the second sound; and when the tube was introduced between the valves, and gently rubbed up and down, a sound resembling the *bruit de râpe* was heard.

"SECTION III.—*The successive Motion of the different Parts of the Heart.*

"From the experiments on the motions of the heart, the following conclusions may be drawn: 1. In the heart of warm-blooded animals, the systole of the ventricles follows immediately the systole of the auricular appendices. 2. During the systole of the ventricles, the auricles are distended by blood from the venous trunks. 3. When their systole has ended, the ventricles becomes relaxed and flaccid; and blood passes rapidly, but not with force, from the auricles into their cavities. 4. The auricles are never emptied of their blood, and contract but little on their contents, an active contraction being observable only in their appendices. 5. If the interval between two successive beats of the heart be regarded as divided into four equal parts, two of these parts may be allotted to the duration of the ventricular systole; something less than one to the interval between the termination of the ventricular systole, and the beginning of the diastole of the appendices, during which interval little motion is observed in the auricles; and the remainder to the diastole and systole of the auricular appendices. 6. The ventricles, in their systole, approach the front of the thorax; and by their contact and pressure against it produce the impulse or beat of the heart. 7. The beat of the heart and the pulse in the arteries are synchronous, only, when the pulse is felt in arteries close to the heart: in those at a distance, the pulses are later than the beat of the heart, by intervals of time proportioned to the distances.

"In the heart of the frog, which was examined in the fourth experiment, the ventricles swelled, and approached the sternum in its diastole, and receded from it in its systole. This difference between the movements of the heart in that animal, and in the other subjects of experiment, may be explained by considering, that in the heart of the latter the swelling of the ventricles, during systole, is produced by the thickening of their muscular fibres, which are then in a state of contraction; and of which the mass bears a large proportion to the size of the internal cavities, while in the heart of the frog, the sides of the ventricle are thin, and the cavity is large, and the increase of thickness of the sides of the ventricle caused by the contraction of their fibres, is more than counterbalanced by the diminution of volume of the ventricle attendant on the expulsion of its contents.

"SECTION IV.

"From the experiments on the sounds of the heart, it appears to follow: 1. That the sounds are not produced by the contact of the ventricles with the sternum or ribs, but are caused by motions within the heart and its vessels. 2. That the sternum and front of the thorax, by their contact with the ventricles, increase the audibleness of the sounds. 3. That the first sound is connected with the ventricular systole, and coincides with it in duration. 4. That the cause of the first sound is one which begins and ends with the ventricular systole, and is in constant operation during the continuance of that systole. 5. That it does not depend on the closing of the auriculo-ventricular valves at the commencement of the systole, because such movement of the valves takes place only at the commencement of the systole, and is of much shorter duration than the systole. 6. That it is not produced by the friction of the internal surfaces of the ventricles against each other, as such friction cannot exist until the blood has been expelled from the ventricles, whereas the first sound commences with the beginning of the ventricular systole. 7. That it is produced either by the rapid passage of the blood over the irregular internal surfaces of the ventricles on its way towards the mouths of the arteries, or by the *bruit masculaire* of the ventricles, or probably by both these causes. 8. That the second sound coincides with the termination of the ventricular systole, and requires for its production the integrity of the semilunar valves of the aorta and pulmonary artery, and seems to be caused by the sudden check given by the action of these valves to the motion of the columns of blood driven towards the heart after each ventricular systole by the elasticity of the arterial trunks.

"The Committee wish, in concluding this report, to express their opinion, that although much light has been thrown on the subject of the motions and sounds of the heart, by recent investigations, here and elsewhere, the nature of the inquiry is such as renders it difficult in many instances to arrive at satisfactory conclusions. They also think that the subject, from its importance, whether in a practical view, or as an object of philosophical inquiry, is deserving of further investigation.—*Dublin Journal of Med. and Chem. Science, Sept.* 1835.

8. *On the Differential Pulse.*—Dr. M'Donnell laid before the Medical Section at the meeting in Edinburgh, some curious observations on what he calls the Differential Pulse, and at the meeting in Dublin he presented some further remarks on the same subject. Dr. M'Donnell finds that in lying, sitting, or standing, there are three distinct numbers in the pulse, any one of which being given, the rest may be discovered by inference. This variation amounts generally to twelve, fourteen, or sixteen beats per minute, as its normal state, and therefore, that all observations of the number of the pulse, which have been made without reference to this principle, must be considered as nugatory, unless it be implied that the person was in the *horizontal position* when the observation was made. This rule for reducing the number of the pulse to a regular standard applies to health, but not precisely to disease; the effects of posture must be investigated separately in each disease.

The *differential pulse* appears to be confined to man. It is not observed in brutes, probably because, from their form, their posture may be considered as always horizontal; but when placed erect this peculiarity appears also in them.

The variation, in the human species, is at its maximum in tall and feeble subjects, particularly in convalescents from typhus; the minimum is generally found in children. These facts lead to the supposition, that this phenomenon is connected with some hydrostatic law, and not depending entirely on vitality. This, however, is merely thrown out as a conjecture, and requires further investigation. But in whatever manner it may be considered, it is plain that in all attempts to ascertain the effects of remedies, as well as of natural causes, due allowance must be made for these fixed differences produced by posture. What avails it to say that a medicine, or venesection, or heat, or cold, or a thousand other natural causes, raise or depress the pulse by four, six, or eight beats per minute, when the mere change of posture would raise or depress it twelve, fourteen, or sixteen per minute, and this merely in health, for in disease the differential pulse is often double this proportion.

In tracing the connexion between the pulse and respiration in man and quadrupeds, he finds that it ranges in health from four to six pulses for one respiration. This he considers a new and material fact; for if it be established by further observation, that this is a general law, we shall be able to infer the pulse from the respiration, and *vice versâ*. This may be of advantage in enabling us to ascertain the number of the pulse in ferocious animals which we dare not touch, as well as in man during action or progression.

There is a coincidence between the number of pulses and steps in walking, at the common rate of progression in man, that is very remarkable, and has not been hitherto noticed. His breathings are also singularly proportioned to his steps, so that it is easy to deduce these numbers from each other. But in hard labour or violent muscular exertion, as in running or ascending heights, the proportions are greatly altered. The same thing occurs in many forms of disease. There is reason to believe that the carbonization of the respired air has a great influence in all those cases where the number of respirations is greatly disturbed.

Dr. M'Donnell finds that the number of respirations, and by inference the number of pulses, are much the same in passing over the same space, whether we run or walk, i. e. they depend as much upon the space traversed as on the time. Thus he finds, if he walks 1000 yards in ten minutes or in eight, or runs over it in five minutes, the number of breathings are nearly the same. It is to be observed, however, that this rule does not apply to small portions of space, such as fifty or 100 yards. These facts, he thinks, are all complicated with carbonization and muscular motion, so as to require separate investigations.

In quadrupeds, especially when trotting or cantering, he has found that the steps, divided by the respirations, never give any fraction in the quotient, i. e. that these are universally proportional without any deviation. In man this does not occur, a circumstance which may arise from some peculiar anatomical or physical law in the connexion between the respiratory and muscular construction of these animals.

Dr. M'Donnell next referred to three errors observable in a work on consumption, published by Dr. Sanders, in 1808, first as to his claim to priority in noticing the differential pulse; secondly, as to his explanation of its cause; and thirdly, as to his idea that the amount of the differential pulse is always directly proportioned to the natural or standard velocity of the pulse. It is true, when we rise erect from the horizontal position, a greater number of muscles are brought into action, but this has nothing to do with the phenomenon in question. He had proved this by placing different persons in an apparatus, so constructed that the body could be placed in all postures without any muscular motion, and he found that the differential pulse followed all the angles of elevation exactly, and this even in persons when asleep. But when the body is inverted, with the head lowered and the feet raised, this rule does not hold good. This part of the subject he proposes to follow at a future opportunity.

Dr. M'Donnell next referred to exceptions to the doctrine of the differential pulse made by his friend Mr. Travers Blackley of Dublin. He had himself met with persons apparently in health in whom there was little or no differential pulse, but from some recent observations he is inclined to think that some of these exceptions may have arisen from disease of the heart or great arteries. He had certainly found the maximum of the differential pulse in aneurisms of the descending aorta, in three or four cases of which the pulse doubled on rising erect. Nevertheless it was fair to acknowledge that Mr. T. Blackley had found the most permanent or stationary pulses in cases of organic lesion of the heart. These facts, though apparently contradictory, may both be true, and may tend to establish a just explanation when they are more numerous and more perfectly understood.

The greater number of these observations occurred to Dr. M'Donnell before he became acquainted with the writings of Laennec. Although Laennec's discoveries have given a new turn to the subject, and created a more lively interest about the sounds of the heart, yet it gives a greater value to the foregoing facts as far as they are substantiated. One thing invariably occurred, that, in proportion as the pulse was accelerated or retarded, by change of posture, its strength and fulness were affected in an inverse ratio. He thought that an attention to this circumstance might probably assist in forming a more just measure of the strength and fulness of the pulse than any hitherto known, but puts this forward merely as a conjecture.

While engaged in these inquiries about thirty years since, he had found that the pulse in the arteries of the fœtus, before it breathed, was *slower* than in those of the mother. He had found also, that if the child, when born, remained for some time without breathing, the pulse continued slow during that interval, and became accelerated only at the instant it took in its first breath. This fact appearing to him new, he had investigated the circumstance in the cow, and finding the phenomena similar, he had communicated his observations to Dr. Clarke, Dr. Labatt, Dr. Stokes, and Dr. Douglas in Dublin, none of whom had ever noticed it in any author. Dr. Jefferay mentioned it in his lectures, and in his "Observations on the Heart and on the Peculiarities of the Fœtus," and thought it might hold true of quadrupeds, and perhaps of all warm-blooded animals. He thought it probable that the fœtus before respiration was in the condition of a cold-blooded animal, and partook of that slowness of the pulse which characterizes the tribe. There is in the present state of our knowledge great difficulty in reconciling the slow pulse in the arteries of the fœtus with the rapidity of the sounds as heard by the stethoscope. How are we to reconcile such contradictory facts, as that 150 strokes or more should be heard by the stethoscope, while the pulse of the child is only 50 or 60? Supposing both these points established by observation, he would submit the following hypothesis in explanation, viz. that although there are but two sounds of the heart heard for every pulsation of an artery in the adult, it does not follow that the same ratio should exist in the fœtus. While the foramen ovale remains open and in the full performance of its office, it is plain that the two auricles cannot contract simultaneously; because in that case the blood could not be freely transmitted, the one driving it forward, the other backward at the same instant. Therefore, until nature closes that aperture, the right auricle must contract first, and the left immediately afterwards, while the ventricles will contract in unison as they do in the adult. Hence it happens, (if this hypothesis be true,) that instead of having two sounds of the heart for every arterial pulse, we shall have three or four.

I am aware, that it has been asserted, that neither of the sounds of the heart are produced by the auricles; but it does not follow that if this be true of the adult, that it should be true of the fœtus, whose circulation is different. Besides, it has not been asserted by any one, that the pulse of the fœtus is slow or quick, but merely that the sounds of the heart are more numerous than in the adult. This matter, however, must be decided by future investigations.

It may appear surprising, how the sounds of the fœtal heart can be transmitted through the liquor amnii, and through the parietes of the uterus and abdomen in the mother, so as to become distinctly audible; but the following simple experiment will serve to explain it. Suspend a watch in a vessel containing many gallons of water, and on applying your ear to any part of the circumference of the vessel, you will hear the beats more distinctly than in the air. The same thing occurs when several folds of cloth are passed round the vessel. Dr. M'Donnell thought this was an argument in favour of the possibility of hearing the sounds of the auricles in the fœtal heart, though they could not be heard in that of the adult.

When the pulse is felt in the funis of a new born child, its strength and fulness appears to be equal to that of the larger arteries in the adult? Whence arises this impulse? While the ductus arteriosus is still open, the blood of both ventricles is driven at one stroke into the descending aorta; whereas in the adult, the blood passing through the descending aorta, merely receives the impulse of the left ventricle. Before respiration takes place, the vessels of the cord pulsate with great force, but as soon as the child breathes, they shrink rapidly and become pale and flat. Now all this occurs when you raise the fœtus and the cord above the level of the placenta. This happens whether the placenta be attached or not, whether the cord pulsates or not, and finally, after the arteries have been tied leaving the vein free.

Dr. M'Donnell concluded his paper with an account of several experiments made in descending twenty-six feet in a diving-bell; the result being that no change whatsoever was observed in the number of the pulse or breathing under all the variable degrees of pressure; but that the carbonization upon every volume of the expired air decreased and increased accordingly as he descended or ascended. Hence he infers that man and all such animals can live, if supplied with pure air, under all degrees of increased pressure, and also at all heights, until the quantity of oxygen in the atmosphere becomes incapable of decarbonating their blood.—*Ibid.*

9. *Gastric Juice.*—The experiments of Dr. Prout, and of Tiedemann and Gmelin in reference to the gastric juice, are confirmed by those of Braconnot, and prove that there is no peculiar substance to which this appellation should be applied, but that the remarkable peculiarity of the stomach is the property which it possesses of secreting a great quantity of muriatic acid. The gastric juice examined by Braconnot was obtained from a dog. He found it to contain.

1. Free muriatic acid in great abundance. 2. Muriate of ammonia. 3. Chloride of sodium in very great quantity. 4. Chloride of calcium. 5. A trace of chloride of potassium. 6. Chloride of iron. 7. Chloride of magnesium. 8. Colourless oil with an acid taste. 9. Animal matter soluble in water and alcohol, in very considerable quantity. 10. Animal matter soluble in weak acids. 11. Animal matter soluble in water, and insoluble in alcohol (salivary matter of Gmelin.) 12. Mucus. 13. Phosphate of lime. He found no trace of lactic acid.—*Records of General Science, Jan.* 1836, from *Annales de Chimie,* LIX.

PATHOLOGY.

10. *On the condition of the Vital Powers in Arteries leading to the inflamed parts.*—Dr. Alison communicated to the Medical section of the British Association, at the late meeting in Dublin, some experiments on this subject, in continuation of those read to the section in 1834.—(See preceding vol. of this Journal, p. 183.) He detailed the result of two examinations of the arteries of limbs of horses killed on account of injury and inflammation of single joints, in one case of three weeks', in the other of eight days' standing. The power of contracting on a distending force, and expelling their contents, was tried in the arteries both of the inflamed